US009186973B2

(12) **United States Patent**
Hozumi et al.

(10) **Patent No.: US 9,186,973 B2**
(45) **Date of Patent: Nov. 17, 2015**

(54) **CONNECTOR COMPONENT FOR AN AUTOMOTIVE EQUIPMENT SIDE AND A BATTERY SIDE**

(75) Inventors: **Mamoru Hozumi**, Kariya-shi (JP); **Yoshio Ojima**, Kariya-shi (JP); **Takahiro Fukagawa**, Kariya-shi (JP); **Takashi Murase**, Kariya-shi (JP)

(73) Assignee: **KABUSHIKI KAISHA TOYOTA JIDOSHOKKI**, Aichi-ken (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 43 days.

(21) Appl. No.: **14/000,953**

(22) PCT Filed: **Mar. 13, 2012**

(86) PCT No.: **PCT/JP2012/056447**
§ 371 (c)(1),
(2), (4) Date: **Aug. 22, 2013**

(87) PCT Pub. No.: **WO2012/124700**
PCT Pub. Date: **Sep. 20, 2012**

(65) **Prior Publication Data**

US 2014/0017936 A1 Jan. 16, 2014

(30) **Foreign Application Priority Data**

Mar. 16, 2011 (JP) 2011-058406

(51) **Int. Cl.**
H01R 13/64 (2006.01)
B60K 1/04 (2006.01)
H01R 13/631 (2006.01)

(52) **U.S. Cl.**
CPC ***B60K 1/04*** (2013.01); ***H01R 13/6315*** (2013.01); *B60K 2001/0438* (2013.01); *B60K 2001/0472* (2013.01)

(58) **Field of Classification Search**
CPC H01R 13/5202; H01R 13/6315; H01R 13/631; B60K 1/04
USPC 439/527, 246, 247, 248
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,909,748 A * 3/1990 Kozono et al. 439/247
7,393,228 B2 * 7/2008 Kabasawa et al. 439/247

(Continued)

FOREIGN PATENT DOCUMENTS

JP 63-127072 U 8/1987
JP 09259973 A 10/1997

(Continued)

OTHER PUBLICATIONS

Translation of the International Preliminary Report on Patentability issued for corresponding International Patent Application No. PCT/JP2012/056447 mailed Sep. 19, 2013.

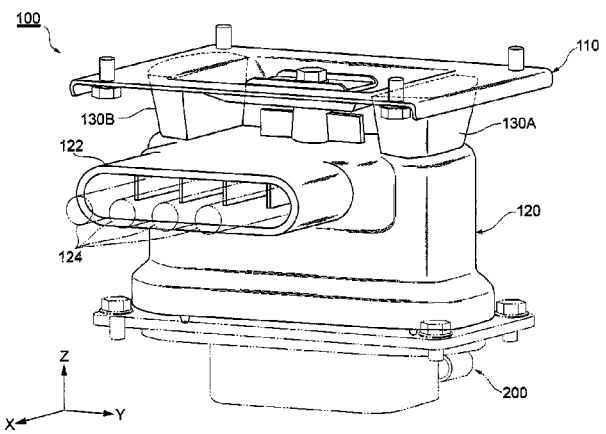
(Continued)

Primary Examiner — Hae Moon Hyeon
(74) *Attorney, Agent, or Firm* — Sughrue Mion, PLLC

(57) **ABSTRACT**

Provided is a connector component that allows easily performing coupling of connectors with each other. In a connector component (a vehicle-side electrical connector) according to an embodiment of the present invention, a vehicle-side connector is mounted on a base bracket via mounting members formed of rubber, elastic deformation of the mounting members permits a relative positional displacement of the base bracket and the vehicle-side connector in a compressing direction (Z-direction) as well as a relative positional displacement in a sliding direction (a direction in an X-Y plane). Therefore, even when there is a positional displacement and/or inclination between the vehicle-side electrical connector and a battery-side electrical connector and a relative positional displacement in the sliding direction has occurred, self-correction is performed by elastic deformation of the mounting members. Thus, according to the vehicle-side electrical connector, coupling when coupling the battery-side electrical connector can be easily performed.

9 Claims, 14 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

7,713,076	B2 *	5/2010	Arts et al.	439/248
8,516,687	B2 *	8/2013	Hozumi et al.	29/729
8,585,421	B2 *	11/2013	Yamaguchi et al.	439/248
2008/0274634	A1	11/2008	Kabasawa et al.	
2008/0293277	A1 *	11/2008	Kumar et al.	439/247
2009/0137145	A1	5/2009	Arts et al.	
2010/0112843	A1	5/2010	Heichal et al.	

FOREIGN PATENT DOCUMENTS

JP	2004-327169	A	11/2004
JP	2007-179942	A	7/2007
JP	2007-280913	A	10/2007
JP	2009-295492	A	12/2009
JP	2010-225488	A	10/2010
JP	2010-272242	A	12/2010
JP	2011-034935	A	2/2011
JP	2011-098644	A	5/2011
JP	2011-103259	A	5/2011

OTHER PUBLICATIONS

International Search Report for corresponding International Patent Application No. PCT/JP2012/056447 mailed May 22, 2012.

Communication dated Apr. 21, 2015, issued by the State Intellectual Property Office of the People's Republic of China in counterpart Application No. 201280013060.6.

Communication dated Jul. 8, 2015, issued by the European Patent Office in counterpart Application No. 12757092.7.

* cited by examiner

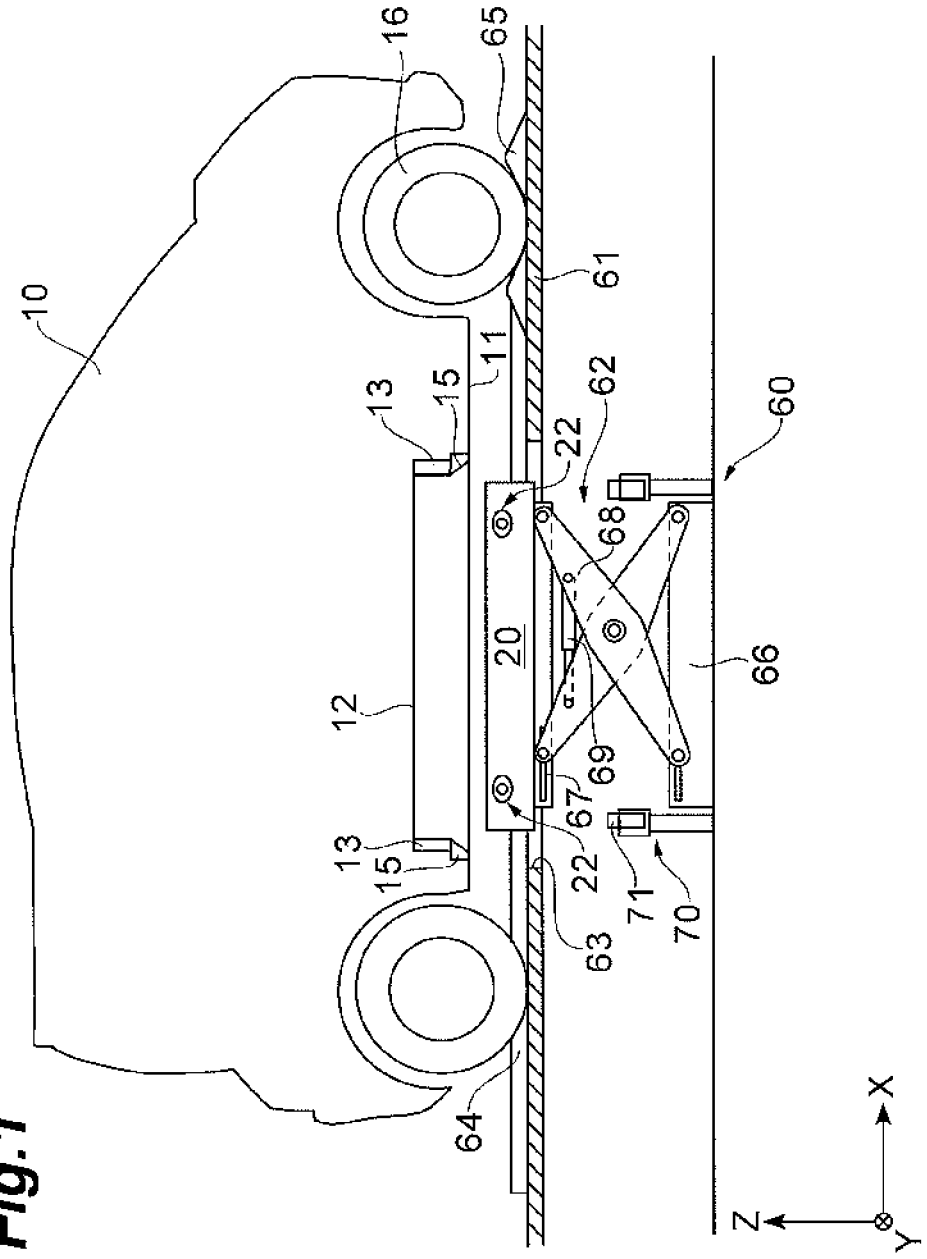


Fig.1

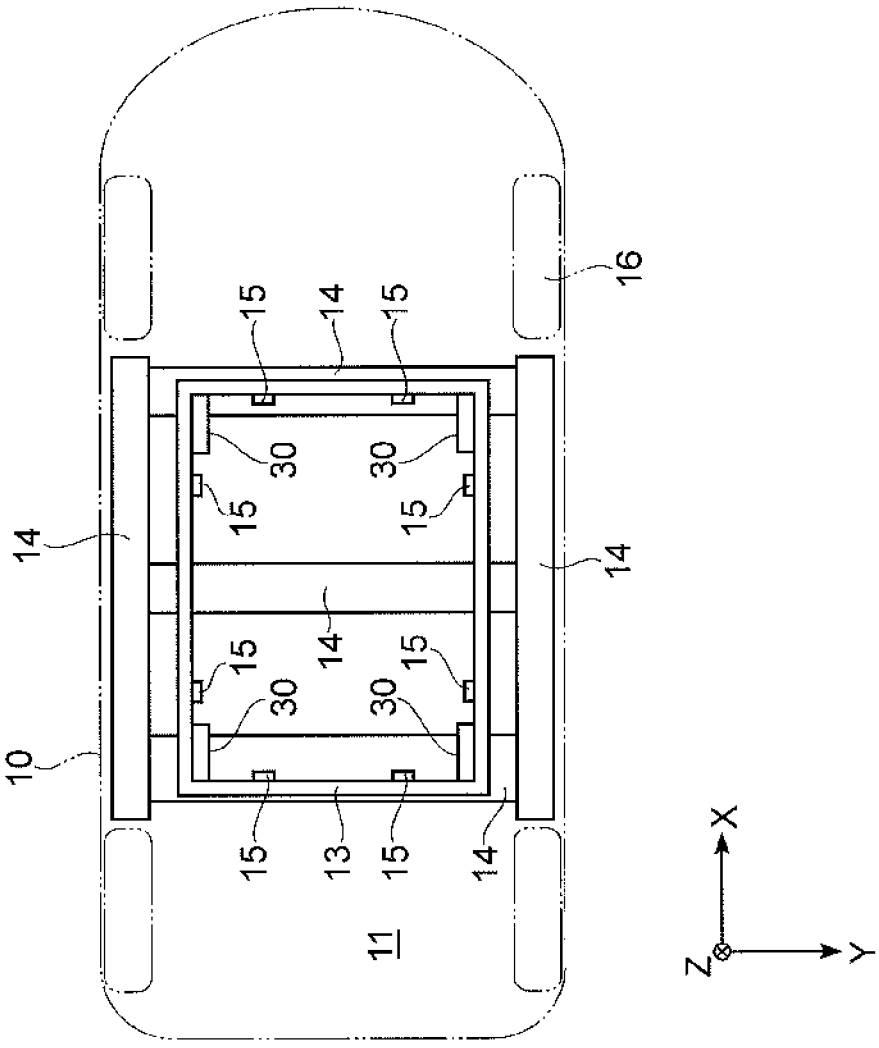


Fig.2

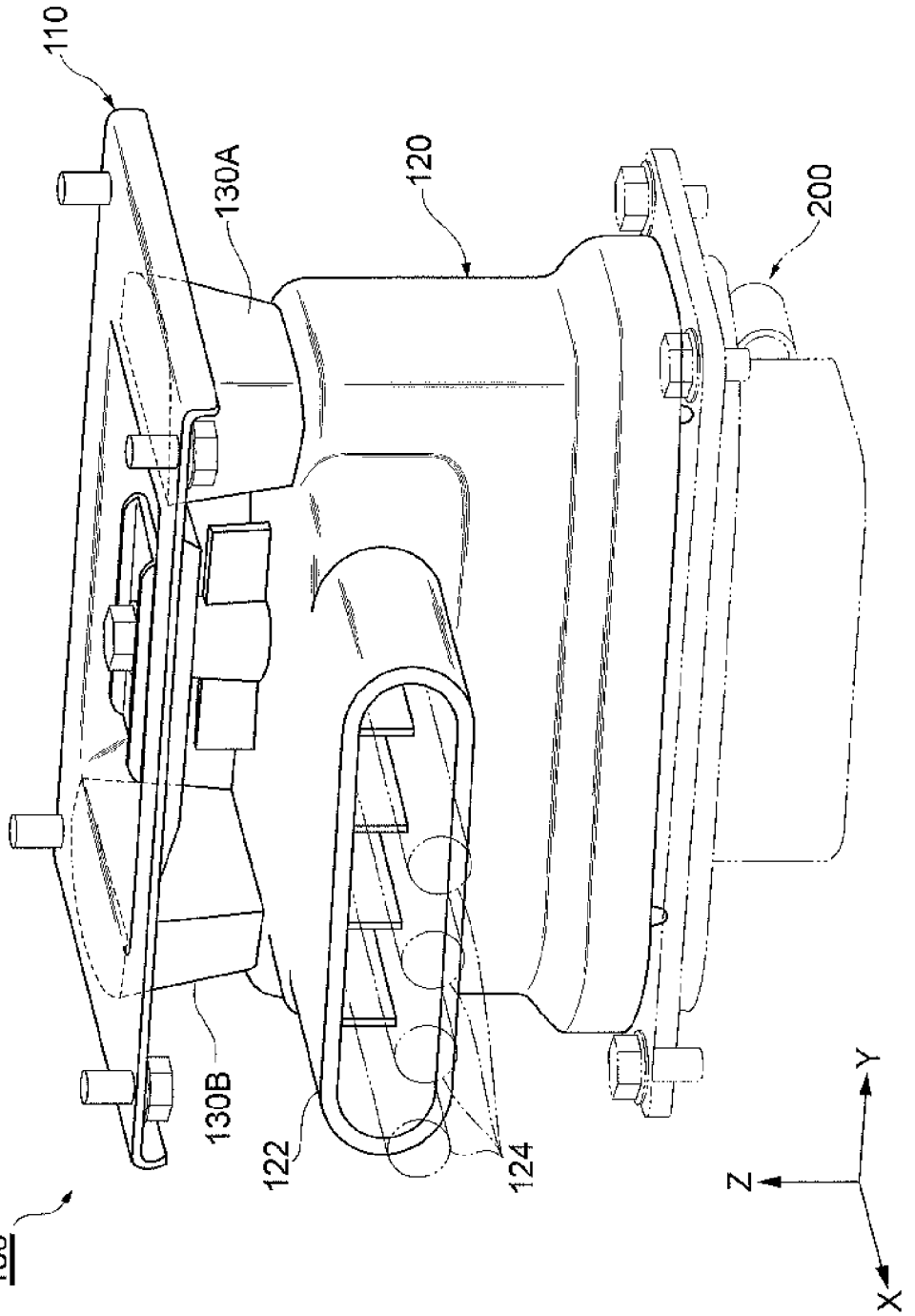


Fig.3

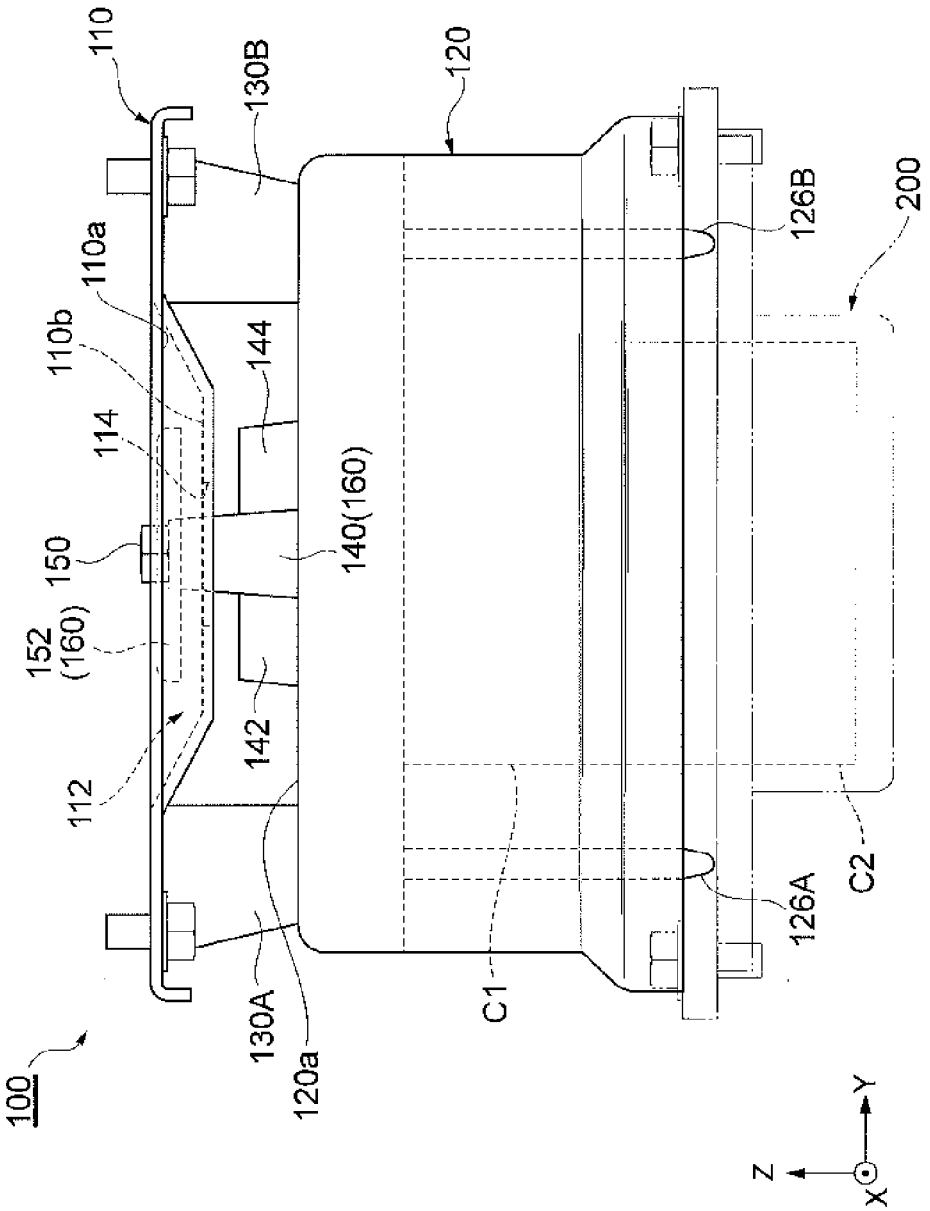

110
130B
120
126B
200
110a
110b
144
114
140(160)
150
152
(160)
142
112
130A
120a
C1
126A
C2
100
Z
Y
X

Fig.4

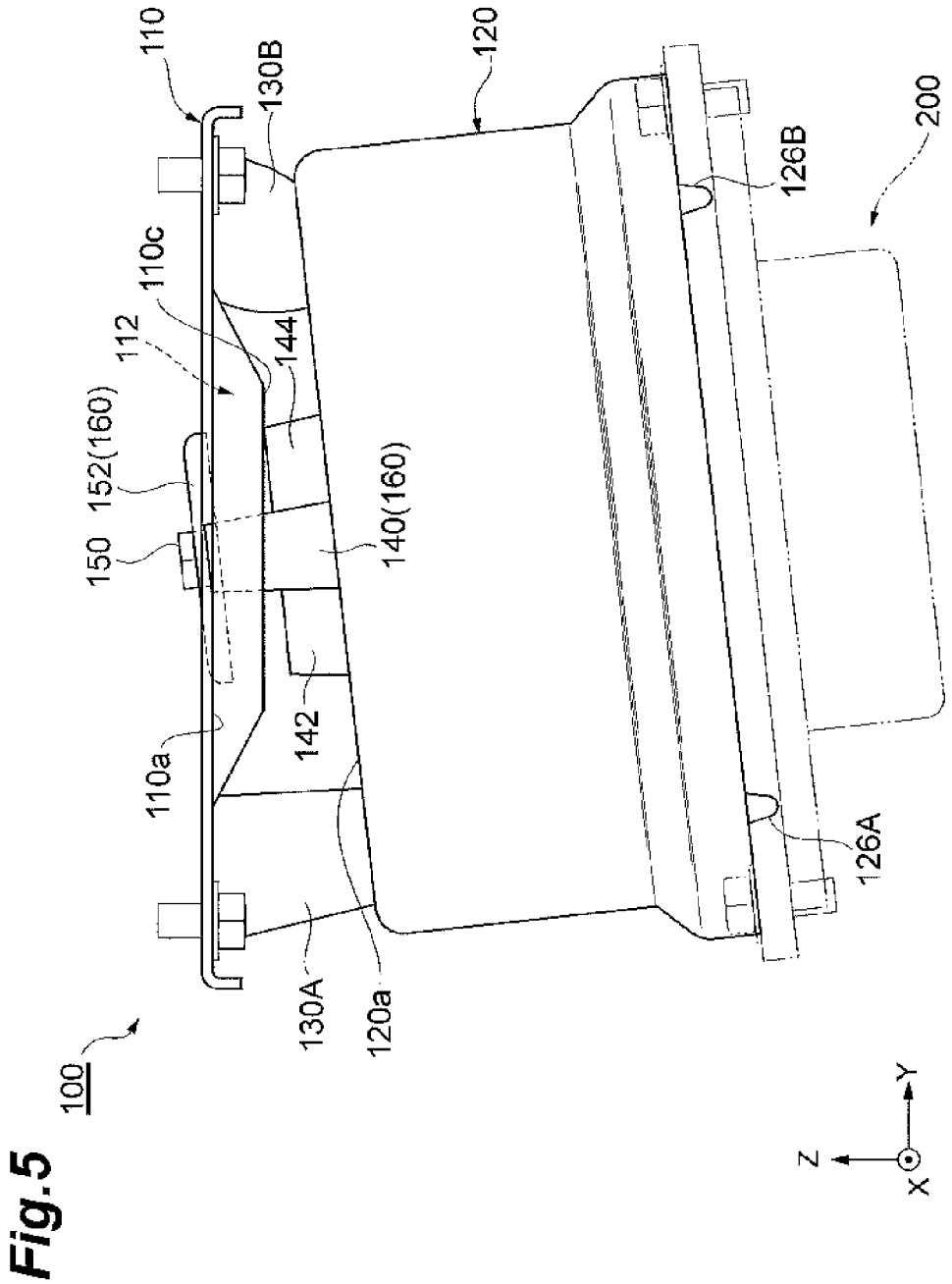

110
130B
120
200
126B
110c
112
144
152(160)
150
140(160)
142
110a
126A
130A
120a
100
Z
Y
X

Fig.5

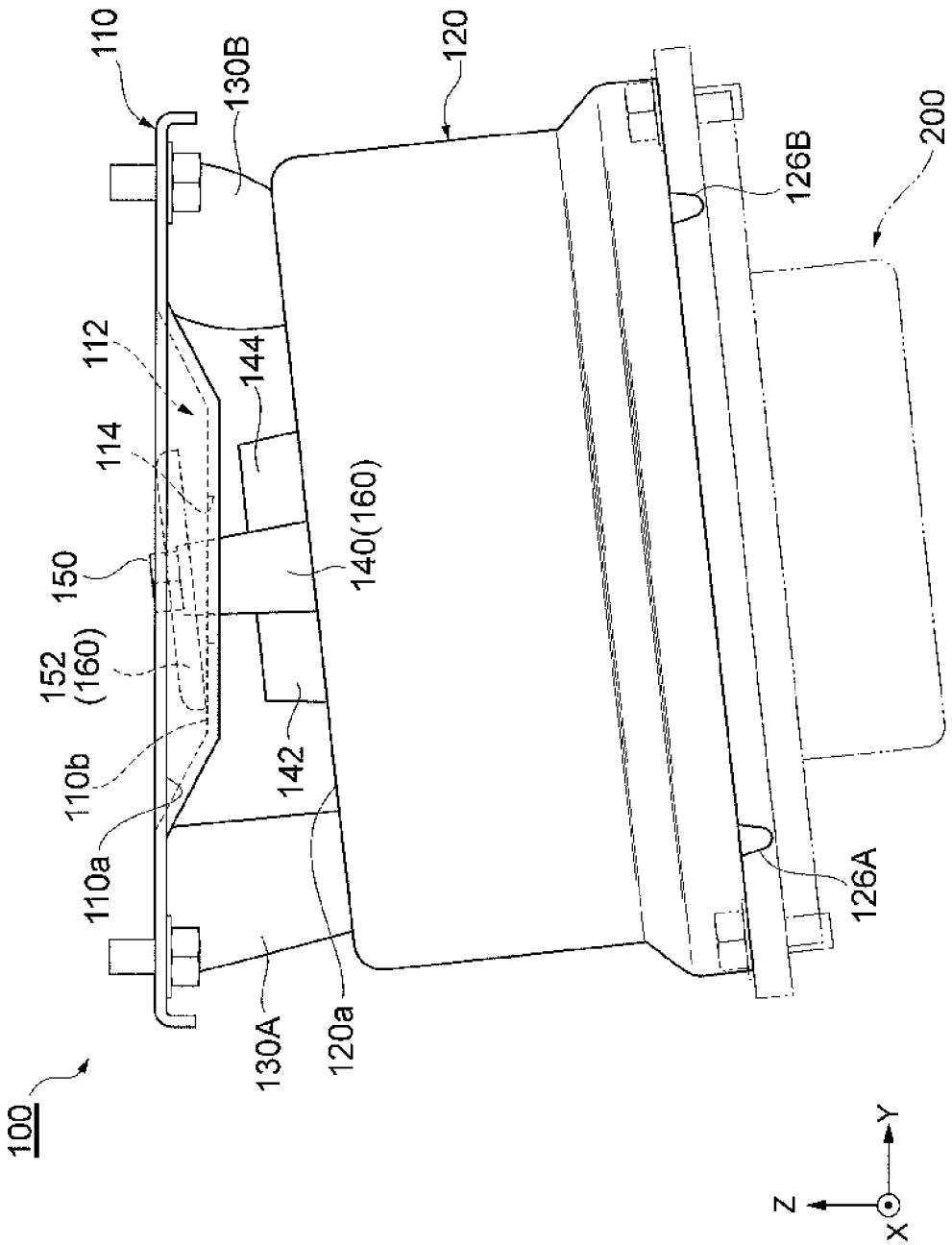
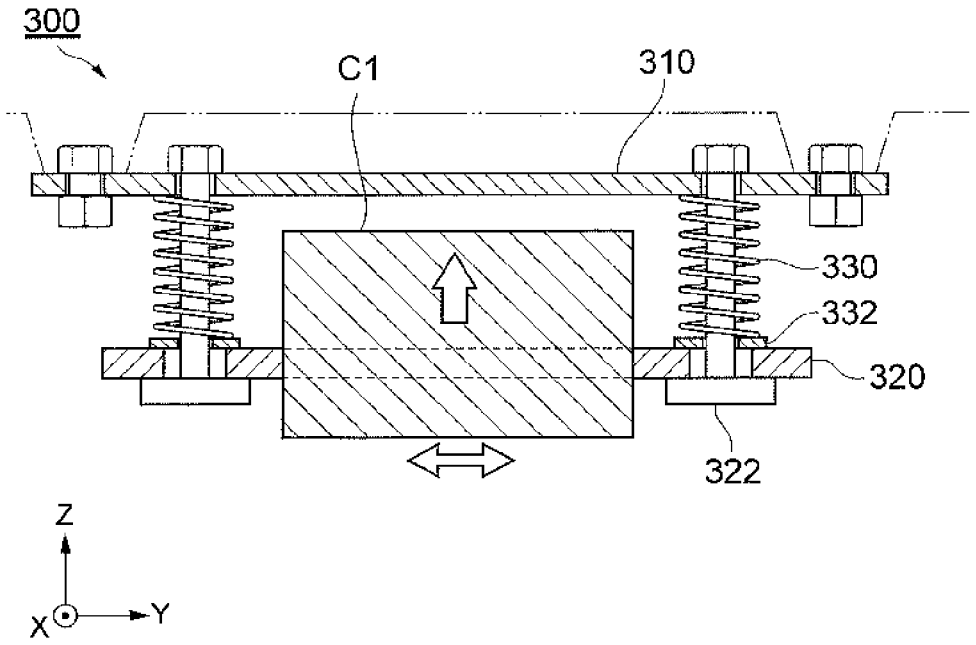

110
130B
120
200
126B
112
144
114
140(160)
150
152
(160)
110b
142
110a
126A
130A
120a
100
Y
Z
X

Fig.6

Fig.7 PRIOR ART



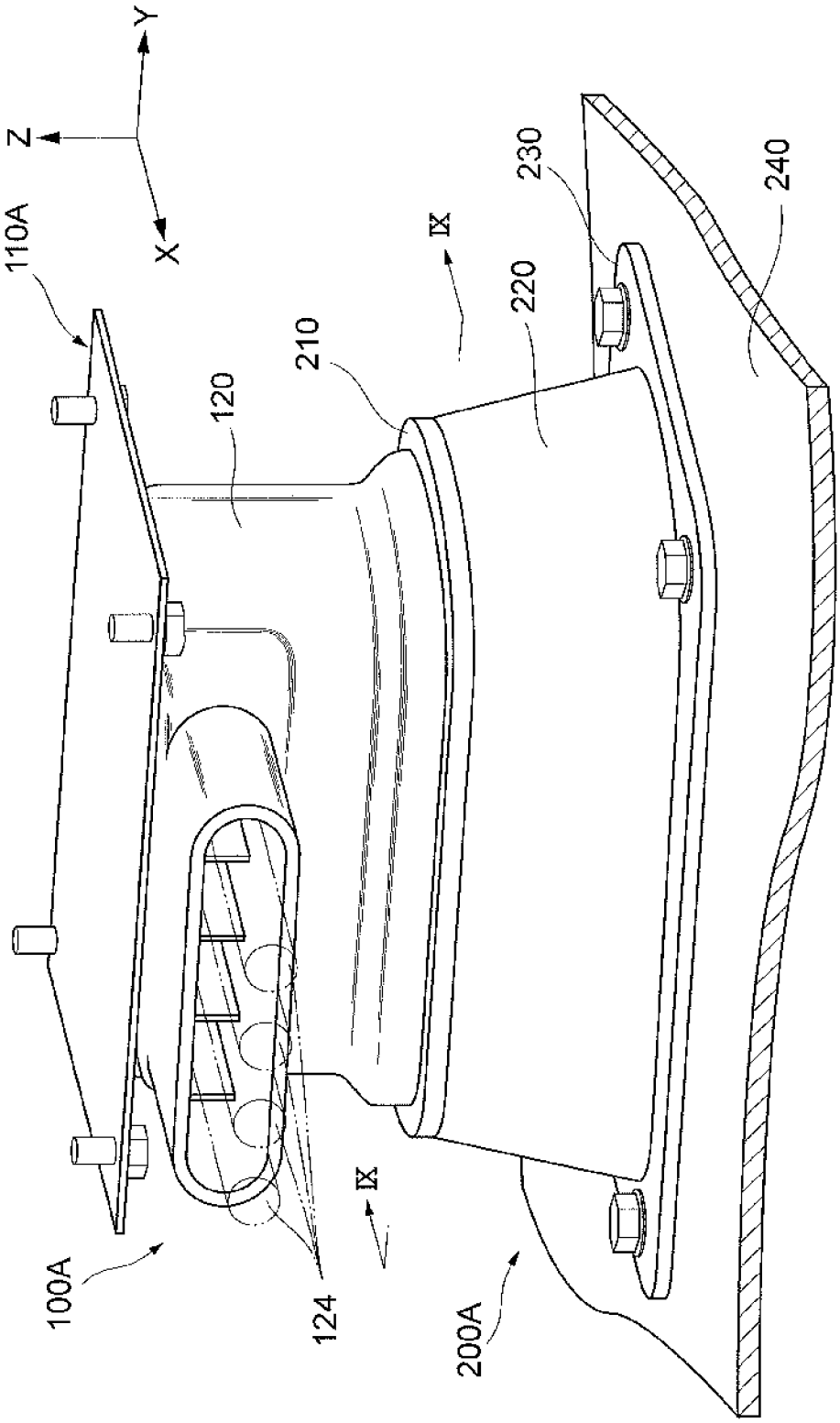


Fig.8

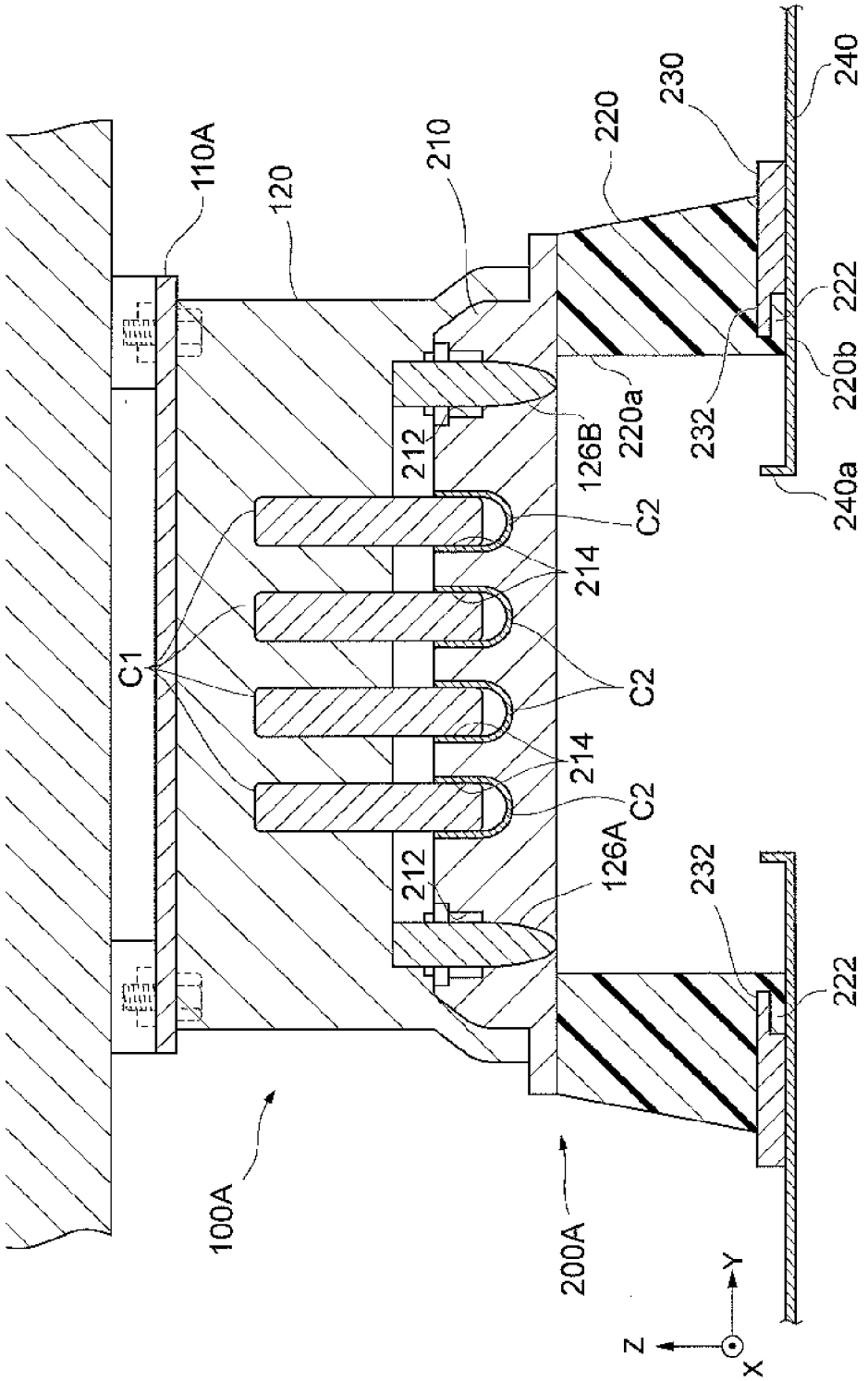

110A
120
210
220
230
240
222
220b
220a
232
240a
126B
212
C2
214
C1
126A
100A
200A
Z
Y
X

Fig.9

Fig.10

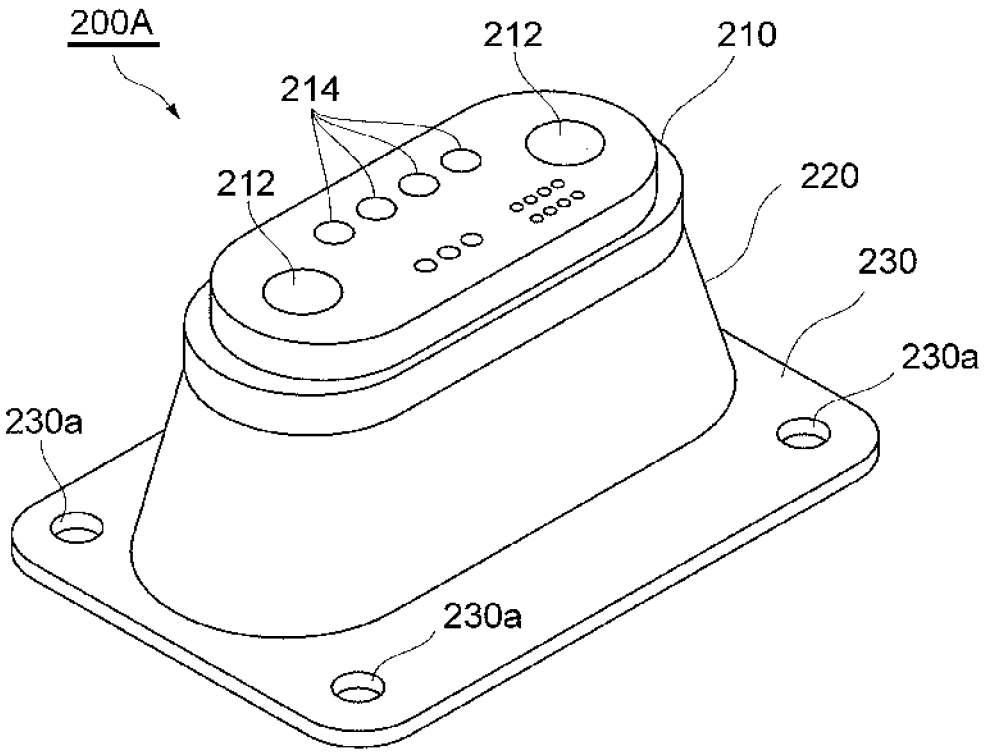
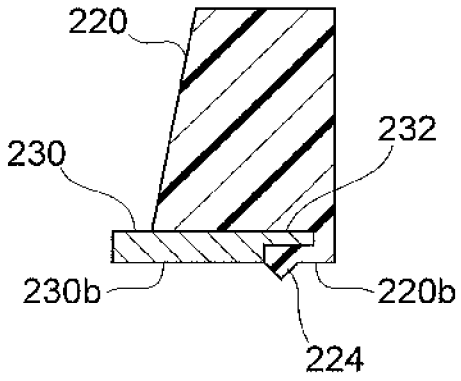
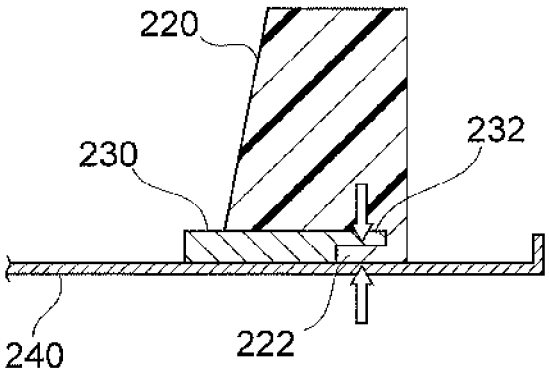


Fig.11

(a)



(b)



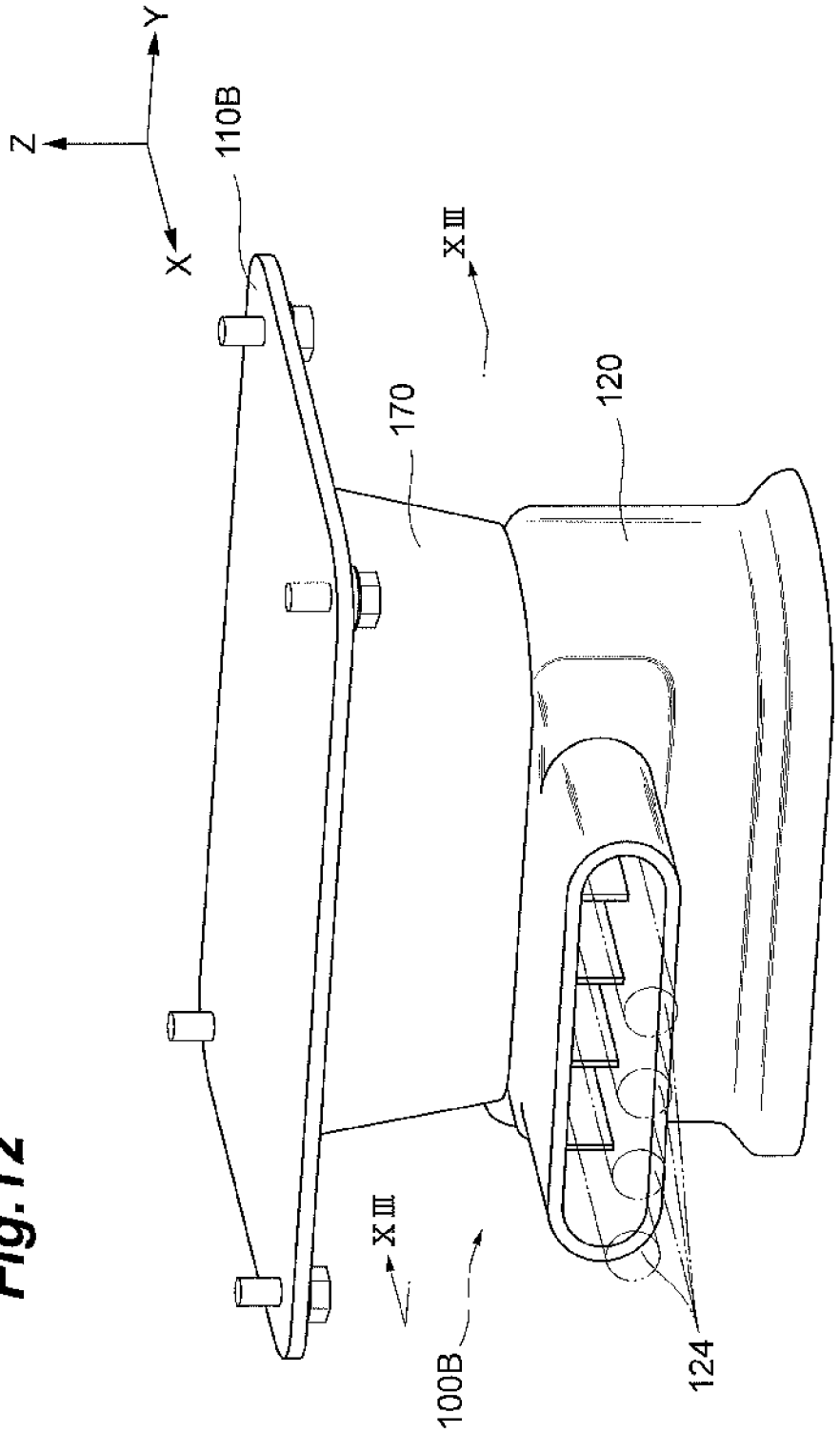


Fig.12

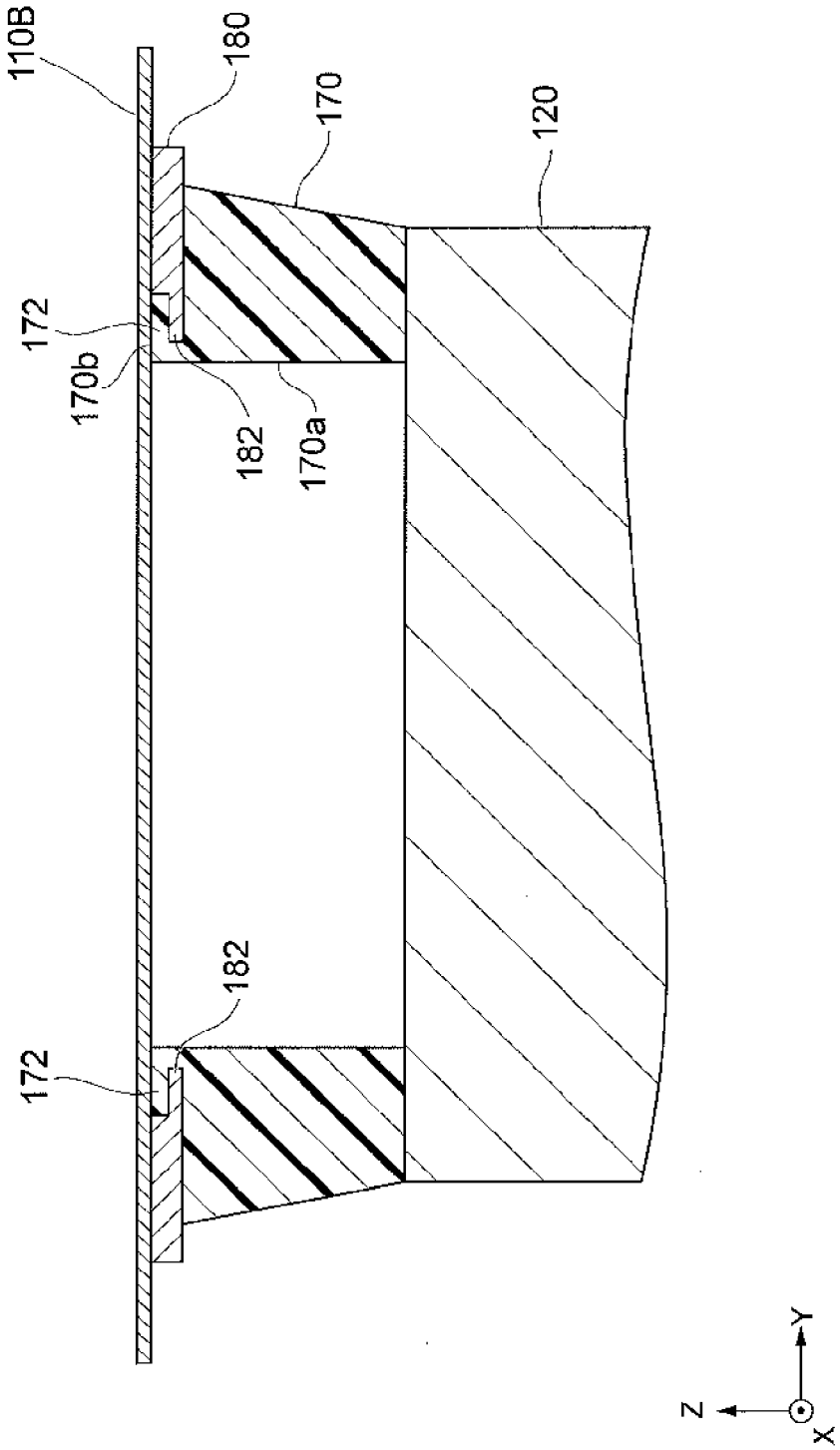
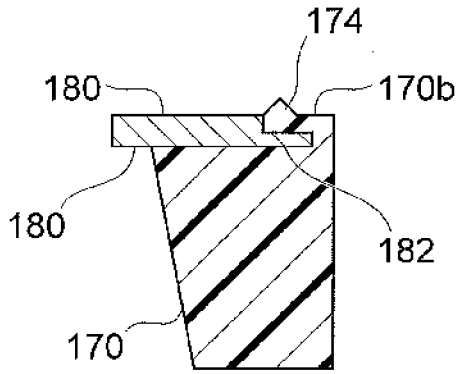


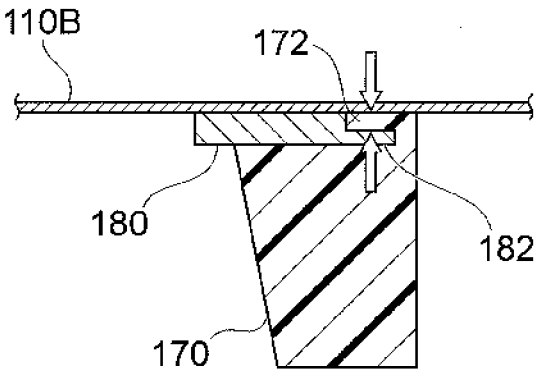
Fig.13

Fig.14

(a)



(b)



CONNECTOR COMPONENT FOR AN AUTOMOTIVE EQUIPMENT SIDE AND A BATTERY SIDE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a National Stage of International Application No. PCT/JP2012/056447 filed Mar. 13, 2012, claiming priority based on Japanese Patent Application No. 2011-058406 filed Mar. 16, 2011, the contents of all of which are incorporated herein by reference in their entirety.

TECHNICAL FIELD

The present invention relates to a connector component including a connector that composes a connector pair on an automotive equipment side and a battery side for mounting a battery in an automobile.

BACKGROUND ART

Recently, in the field of electric vehicles, research on removable traveling batteries has advanced. When mounting such a battery in a vehicle, simultaneously therewith, a battery-side connector and a connector on the side of electrical equipment mounted in the automobile are coupled. In that case of coupling, a relative positional displacement and/or inclination between the connectors may occur, and it is preferable that the connector component itself has a function of self-correcting these. The following Patent Literature 1 discloses an art, to be used for an automotive sliding door, in which connectors self-correct their positions with respect to each other when being coupled.

For example, in the connector component **300** shown in FIG. **7**, a base bracket **310** to be fixed to a vehicle body and a support plate **320** that supports an automotive equipment-side connector terminal C**1** have a configuration to allow permitting, by a compressive reaction force of coil springs **330** disposed at four corners of the connector terminals C**1** and wound around fixed shafts **322** that penetrate through the support plate **320**, a relative positional displacement in a compressing direction (the Z-direction in the figure) to some extent.

CITATION LIST

Patent Literature

Patent Literature 1: Japanese Patent Application Laid-Open No. 2007-179942

SUMMARY OF INVENTION

Technical Problem

However, the connector component **300** described above does not have a function of permitting a relative positional displacement in a sliding direction (a direction in an X-Y plane of the figure) between the base bracket **310** and the support plate **320**. Therefore, in such a case of relative positional displacement, a coil spring deflection and a sliding movement between the coil spring **330** and the support plate **320** (or a sliding movement between these and a washer **332**) occurs, and it is considered that contact between the constituent members such as metal components can cause the occurrence of wear and noise of the members. Further, a situation that metal powder caused by wear enters into a connector is also likely to occur.

The present invention has been made to solve the foregoing problems, and an object thereof is to provide a connector component that allows easily performing coupling of connectors with each other.

Solution to Problem

A connector component according to the present invention is a connector component including a connector that composes a connector pair on an automotive equipment side and a battery side for mounting a battery in an automobile, further including a base bracket to be fixed to a vehicle body or the battery, and a mounting member formed of an elastic material, for causing the connector to be mounted in a state spaced at a predetermined interval with respect to the base bracket, in which the connector and the base bracket are integrally constructed via the mounting member.

In such a connector component, because the base bracket is mounted with the connector via the mounting member formed of an elastic material, elastic deformation of the mounting member permits a relative positional displacement of the base bracket and connector not only in a compressing direction but also in a sliding direction. Therefore, even when the connector of the connector pair has a positional displacement and/or inclination from each other and a relative positional displacement in the sliding direction has occurred, self-correction is performed by elastic deformation of the mounting member. Thus, the connector component according to the present invention allows easily performing coupling of connectors with each other.

Also, there may be a mode in which the mounting member is formed of rubber.

Moreover, there may be a mode in which the mounting member is bonded to the connector and the base bracket by vulcanization bonding. In this case, a sliding movement does not occur at a connection part between the mounting member and the connector, so that the occurrence of wear and noise of the members can be suppressed.

Moreover, there may be a mode in which the base bracket is provided with an opening portion on which a stopper portion that projects from a front surface of the connector closer to the base bracket is locked in a penetrating manner, and by cooperation of the stopper portion of the connector with the opening portion of the base bracket, detachment of the connector from the base bracket is prevented.

Moreover, there may be a mode in which, on one front surface out of a front surface of the base bracket closer to the connector and a front surface of the connector closer to the base bracket, a restricting portion that projects toward the other front surface, and restricts inclination of the base bracket and the connector by being brought into contact with the other front surface is provided.

Moreover, there may be a mode of further including a mounting attachment for fixing the mounting member to the base bracket, in which the mounting member is in a tubular shape extending in an opposing direction between the connector and the base bracket, the mounting attachment has an annular eaves portion embedded in the mounting member so as to surround an inner hole of the mounting member, and not to be brought into contact with the base bracket, and the mounting member has an annular projection portion formed at a position, of a surface opposed to the base bracket, corresponding to the annular eaves portion.

In this case, when the mounting member is attached to the base bracket, the annular projection portion formed on the surface opposed to the base bracket of the mounting member is compressed sandwiched between the eaves portion of the mounting attachment and the base bracket. As a result, a high internal stress is produced in an annular part surrounding the inner hole of the mounting member, sandwiched between the eaves portion of the mounting attachment and the base bracket, so that high sealability in the inner hole of the mounting member is realized.

Also, the connector component according to the present invention may be an automotive equipment-side connector component, and may be a battery-side connector component.

Advantageous Effects of Invention

The present invention provides a connector component that allows easily performing coupling of connectors with each other.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a view showing a mounted state of a battery unit of an electric vehicle according to an embodiment of the present invention.

FIG. **2** is a view showing a bottom surface of the electric vehicle shown in FIG. **1**.

FIG. **3** is a perspective view showing a vehicle-side electrical connector according to a first embodiment of the present invention.

FIG. **4** is a side view of the vehicle-side electrical connector shown in FIG. **3**.

FIG. **5** is a view showing an inclined state when a battery-side electrical connector is connected to the vehicle-side electrical connector shown in FIG. **4**.

FIG. **6** is a view showing an inclined state when a battery-side electrical connector is withdrawn from the vehicle-side electrical connector shown in FIG. **4**.

FIG. **7** is a view showing a connector component according to the conventional art.

FIG. **8** is a perspective view showing a connector pair according to a second embodiment of the present invention.

FIG. **9** is a sectional view taken along a line IX-IX of the connector pair shown in FIG. **8**.

FIG. **10** is a perspective view showing a mounting member and a mounting attachment according to the second embodiment of the present invention.

FIG. **11** includes views showing (a) a state of the mounting member before attachment and (b) a state of the mounting member after attachment.

FIG. **12** is a perspective view showing a connector pair according to a third embodiment of the present invention.

FIG. **13** is a sectional view taken along a line XIII-XIII of the connector pair shown in FIG. **12**.

FIG. **14** includes views showing (a) a state of a mounting member before attachment and (b) a state of the mounting member after attachment.

DESCRIPTION OF EMBODIMENTS

Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. Also, in the description, for the same elements or elements having the same functions, the same reference signs will be used, and overlapping description will be omitted.

First Embodiment

Hereinafter, a mounted state of a battery unit of an electric vehicle according to a first embodiment of the present invention will be described while referring to FIG. **1** to FIG. **3**. Also, the coordinate axes in the figures are shown with reference to a vehicle, in which the X-axis indicates a front-rear direction of the vehicle, the Y-axis indicates a left-right direction of the vehicle, and the Z-axis indicates a height direction of the vehicle.

As shown in FIG. **1** and FIG. **2**, on a bottom portion **11** of the electric vehicle **10**, a battery fixing portion **12** to and from which a battery unit **20** can be attached and removed from the downside of the vehicle is provided.

The battery fixing portion **12** is composed of a vehicle bottom framework portion **14** such as a floor pan of a vehicle bottom portion, side member rocker portions, and a reinforce that is bridged between the left and right side member rocker portions and a frame body **13** that protects the battery unit **20** attached to the battery fixing portion **12**. The frame body **13** has a rectangular external shape extending in the vehicle front-rear direction, has a framing made of an iron material, and is attached to the vehicle bottom framework portion **14**.

To the vehicle bottom framework portion **14**, battery fixing devices (battery housing supports) **30** are attached so as to contact the inner periphery of the frame body **13**. In the present embodiment, four battery fixing devices **30** are attached, at the four corners of the frame body **13**, so as to contact left and right sides located on the sides of vehicle side surfaces.

Moreover, to the frame body **13**, vehicle-side guide pieces **15** that widen in a tapered manner toward the downside of the vehicle are provided two each for each side. Further, to the frame body **13**, a vehicle-side electrical connector **100** to be described later for electrically connecting automotive equipment mounted in the vehicle and the battery unit **20** is attached.

To the outer surface of the battery unit **20**, strikers **22** for fixing the battery unit **20** to the vehicle by being supported on the battery fixing devices **30** are attached.

Moreover, at spots corresponding to the vehicle-side guide pieces **15** in a state of the battery unit **20** being attached to the battery fixing portion **12** of the vehicle, semi-cylindrical battery-side guide pieces are attached. Further, at a spot corresponding to the vehicle-side electrical connector **100** in the battery unit **20**, a battery-side electrical connector **200** to be described later is provided, and in a state where the battery unit **20** is disposed on the battery fixing portion **12**, the vehicle-side electrical connector **100** and the battery-side electrical connector **200** are connected to reach an electrically connected state.

Next, a battery replacing apparatus **60** for replacement of the battery unit **20** of the electric vehicle **10** will be described.

As shown in FIG. **1**, the battery replacing apparatus **60** is disposed underground at its lower section, and is disposed on the ground at its upper section. In the upper section of the battery replacing apparatus **60**, a horizontal loading platform **61** that can carry the electric vehicle **10** is provided, and the loading platform **61** is provided with an opening portion **63** through which the battery unit **20** and a lifting and lowering means **62** that lifts and lowers the battery unit **20** can move up and down and pass. Further, on an upper portion of the loading platform **61**, a pair of positioning rails **64** that perform positioning in the vehicle width direction of the electric vehicle **10** are installed, across the opening portion **63**, so that the battery fixing portion **12** of the electric vehicle **10** is disposed over the opening portion **63**. And, at an end of the

positioning rail **64**, a double bump-shaped wheel stopper **65** that performs positioning in the front-rear direction of the electric vehicle **10** is installed so that the battery fixing portion **12** of the electric vehicle **10** is disposed over the opening portion **63**.

Also, in the electric vehicle **10**, it is desirable that the position of the battery fixing portion **12** with respect to an axle of front wheels **16** has been standardized to be unified in all models. And, at the time of battery replacement of the electric vehicle **10**, the electric vehicle **10** is moved so that the positioning rails **64** are disposed between the front wheels **16** of the electric vehicle **10**. And, by stopping the vehicle so that the front wheel **16** is located at the middle of the double bump-shaped wheel stopper **65**, some degree of alignment is performed between the battery fixing portion **12** of the electric vehicle **10** and the lifting and lowering means **62** of the battery replacing apparatus **60**. Accordingly, it is possible to reduce a positional displacement between the position of the battery fixing portion **12** and the lifting and lowering means **62** in the vehicle front-rear direction caused by a difference in the contact state of a tier against the wheel stopper **65** to a level of a few tens of millimeters.

In the battery replacing apparatus **60**, the lifting and lowering means **62** is provided at a position where the same can move up and down in the up-down direction through the opening portion **63** of the loading platform **61**. The lifting and lowering means **62** is a device for housing the battery unit **20** detached from the electric vehicle **10** in the battery replacing apparatus **60** or transferring a battery unit that has been kept in the battery replacing apparatus **60** to the battery fixing portion **12** of the electric vehicle **10**, and is composed of a base **66**, a transfer table **67**, arms **68**, and a hydraulic cylinder **69** for lifting and lowering the transfer table.

Around the lifting and lowering means **62** in the battery replacing apparatus **60**, a conveying means **70** formed of a chain conveyer **71** is installed. The conveying means **70** is a device that conveys the battery unit **20** between a transfer position to transfer the battery unit **20** between the same and the lifting and lowering means **62** and a battery storage means (not shown). Also, the battery storage means is a device that temporarily stores a recovered used battery unit **20** and stores a charged battery unit **20** after charging, and is constructed by, for example, an automated warehouse.

By the battery replacing apparatus **60** thus configured, the battery unit **20** mounted in the electric vehicle **10** is replaced. At the time of replacement of the battery unit **20**, the electric vehicle **10** is moved onto the loading platform **61** of the battery replacing device, and the front wheel **16** of the electric vehicle **10** is stopped so as to be located at the middle of the double bump shape of the wheel stopper **65**. After the stop, when a battery replacement command is issued, the battery replacing apparatus **60**, by driving the hydraulic cylinder **69**, lifts the transfer table **67** to bring the transfer table **67** into contact with a bottom surface of the battery unit **20** housed in the battery fixing portion **12**.

After the contact, by manually switching a changeover switch provided in the vehicle, locking by the battery fixing devices **30** that have fixed the battery unit **20** to the electric vehicle **10** is released. Thereafter, the battery replacing apparatus **60** lowers the transfer table **67** by driving the hydraulic cylinder **69**, so that the battery unit **20** is housed in the battery replacing apparatus **60**. The housed battery unit **20** is, by the conveying means **70**, conveyed to the battery storage means and kept.

Then, another charged battery unit **20** that has been stored in the battery storage means is taken out of the battery storage means, and conveyed up to the lifting and lowering means **62** by the conveying means **70**. The battery unit **20** conveyed to the lifting and lowering means **62** is lifted by the lifting and lowering means **62**. A positional displacement between the battery fixing portion **12** and the battery unit **20** is corrected, when the battery unit **20** is lifted, by the battery-side guide pieces attached to the battery unit **20** and the vehicle-side guide pieces **15** contacting each other. When the lifting of the battery unit **20** is continued, a positional displacement and/or inclination of the battery unit **20** is corrected by the both-side guide pieces, so that the battery unit **20** is inserted into the battery fixing portion **12**.

Also, around the battery fixing portion **12** of the bottom portion **11** of the vehicle, there are attached a plurality of press switches (not shown), and when all switches have been pressed by the transfer table **67**, it is detected as a state where the battery unit **20** is housed in the battery fixing portion **12**. After the state where the battery unit **20** is housed in the battery fixing portion **12** is detected, by manually activating a changeover switch for a motor provided in the vehicle to bring the battery fixing devices **30** into a locking state, the battery unit **20** is locked, so that the battery of the electric vehicle is replaced.

Here, the vehicle-side electrical connector (connector component) **100** to be attached to the frame body **13** of the battery fixing portion **12** will be described while referring to FIG. **3** and FIG. **4**.

The vehicle-side electrical connector **100** is composed of a base bracket **110**, a vehicle-side connector (automotive equipment-side connector) **120**, and a pair of mounting members **130**A, **130**B.

The base bracket **110** is formed by a rectangular-shaped metal plate, and shaped by cutting and bending. The base bracket **110** is bolted on to the frame body **13** of the battery fixing portion **12** from the side of a lower surface **110***a* at its four corners so as to face the frame body **13**, that is, so as to become parallel with respect to an X-Y plane. At a central portion of the base plate **110**, a portion of a depression **112** that is depressed downward is formed, and a bottom surface **110***b* of the depression portion **112** is provided with an opening portion **114**.

The vehicle-side connector **120** has a substantially rectangular parallelepiped shape extending along the longitudinal direction (Y-direction) of the base bracket **110**. The vehicle-side connector **120** is provided inside thereof with a connector terminal C**1** and various types of wiring. The connector terminal C**1** of the vehicle-side connector **120** is connected to a connector terminal C**2** of the battery-side electrical connector **200**, electric power and a signal input to the connector terminal C**1** are transmitted, via a cable **124**, to predetermined electrical equipment mounted in the electric vehicle **10**. Also, from the lower end of the vehicle-side connector **120**, a pair of alignment pins **126**A, **126**B to be used for alignment with the battery-side electrical connector **200** are disposed lined up in the Y-direction.

On an upper end surface **120***a* of the vehicle-side connector **120**, at a position corresponding to the opening portion **114** of the base bracket **110**, a protrusion portion **140** that projects toward the base bracket **110** side is provided. This protrusion portion **140** has a height to reach the opening portion **114** of the base bracket **110**, and at its top portion, a flange portion **152** is attached by a bolt **150**. The flange portion **152** is a rectangular plate having a width larger than the width of the opening portion **114**, and similar to the base bracket **110**, is provided in parallel with respect to an X-Y plane.

The protrusion portion **140** and the flange portion **152** compose a stopper portion **160**. By this stopper portion **160**, in cooperation with the opening portion **114** of the base

bracket **110**, detachment of the vehicle-side connector **120** from the base bracket **110** is prevented. That is, when the mounting members **130**A, **130**B to be described later have excessively stretched, as a result of the flange portion **152** of the stopper portion **160** having a width larger than the width of the opening portion **114** being locked on the opening portion **114**, a downward movement of the vehicle-side connector **120** is restricted.

On both sides of the protrusion portion **140** in the upper end surface **120***a* of the vehicle-side connector **120**, in a manner integral with the protrusion portion **140**, a pair of planar ribs (restricting portions) **142**, **144** that are parallel with respect to a Y-Z plane are provided symmetrically with respect to the protrusion portion **140**. That is, similar to the protrusion portion **140**, these ribs **142**, **144** also project from the upper end surface **120***a* of the vehicle-side connector **120** toward a lower surface of the base bracket **110**.

The pair of mounting members **130**A, **130**B are members for causing the vehicle-side connector **120** to be mounted in a state spaced at a predetermined interval with respect to the base bracket **110**, and are formed of rubber being a soft material. The connecting positions in the base bracket **110** of the mounting members **130**A, **130**B are on the lower surface of the base bracket **110**, and are both end positions in the longitudinal direction. Moreover, the connecting positions in the vehicle-side connector **120** of the mounting members **130**A, **130**B are on the upper end surface **120***a* of the vehicle-side connector **120**, and are both end positions in the longitudinal direction. Such a connection of the mounting members **130**A, **130**B with the base bracket **110** and the vehicle-side connector **120** is performed by vulcanization bonding. Also, the mounting members **130**A, **130**B both have semi-columnar shapes extending in the Z-direction, and are disposed so that their plane portions face each other.

The vehicle-side electrical connector **100** and the battery-side electrical connector **200** are connected with each other, as described above, when attaching the battery unit **20** to the battery fixing portion **12**. In that case, it is desired to self-correct a positional displacement and/or inclination to some extent. But, the connector component **300** shown in FIG. **7** does not have a function of permitting a relative positional displacement in a sliding direction between the base bracket **310** and the support plate **320**.

Therefore, in such a case of relative positional displacement, a coil spring deflection and a sliding movement between the coil spring **330** and the support plate **320** (or a sliding movement between these and a washer **332**) occurs, and it is considered that contact between the constituent members such as metal components can cause the occurrence of wear and noise of the members. Further, a situation that metal powder caused by wear enters into a connector is also likely to occur.

Furthermore, in the connector component **300**, with regard also to a relative positional displacement in the compressing direction, when some level of large displacement has occurred, similar to a relative positional displacement in a sliding direction, contact between the constituent members is likely to cause the occurrence of wear and noise of the members.

On the other hand, in the vehicle-side electrical connector **100** described above, because the base bracket **110** is mounted with the vehicle-side connector **120** via the mounting members **130**A, **130**B formed of rubber, for the base bracket **110** and the vehicle-side connector **120**, a relative positional displacement in the compressing direction (Z-direction) as well as a relative positional displacement in a sliding direction (a direction in an X-Y plane) are permitted by elastic deformation of the mounting members.

Therefore, even when there is a positional displacement and/or inclination between the vehicle-side electrical connector **100** and the battery-side electrical connector **200** and a relative positional displacement in the sliding direction has occurred, self-correction is performed by elastic deformation of the mounting members **130**A, **130**B. Thus, according to the vehicle-side electrical connector **100**, coupling when coupling the battery-side electrical connector **200** can be easily performed.

Moreover, there is a setting so that, in a state of the battery unit **20** being attached to the battery fixing portion **12**, the battery unit **20** is fixed to a position where the mounting members **130**A, **130**B are compressed by the battery-side electrical connector **200**. As a result, the mounting members **130**A, **130**B apply an urging force downward to the battery unit **20**, so that vibration in the up-down direction during vehicle traveling can be prevented.

Also, in the foregoing case of elastic deformation of the mounting members **130**A, **130**B, because contact between the constituent members does not occur, the occurrence of wear and noise of the members is suppressed. Particularly, in the embodiment described above, because the mounting members **130**A, **130**B and the base bracket **110** and the vehicle-side connectors **120** are bonded by vulcanization bonding, the occurrence of wear and noise of the members is more effectively suppressed.

Additionally, for the vehicle-side electrical connector **100**, because the vehicle-side connector **120** and the base bracket **110** are integrally constructed via the mounting members **130**A, **130**B, in the case of mounting, components such as spring coils, fixed shafts, and washers are no longer necessary, and a reduction in cost and the number of components is also achieved.

The volume and shape of mounting members can be appropriately changed, and can also be displaced selectively (or preferentially) in a direction that meets a condition. Moreover, because elastic deformation of the mounting members makes vibration of the vehicle-side connector **120** less likely to be transmitted to the base bracket **110** and the vehicle, silence of the cabin interior and the like is improved. Further, due to insulation properties of the mounting members, a situation that a high voltage that is input to the vehicle-side connector **120** leaks to the vehicle body due to failure or the like can be avoided.

Then, the function of the ribs **142**, **144** provided on the upper end surface **120***a* of the vehicle-side connector **120** will be described while referring to FIG. **5**.

When connecting the vehicle-side electrical connector **100** and the battery-side electrical connector **200**, an upward external force in the Z-direction such as to bring the vehicle-side connector **120** close to the base bracket **110** is applied. In that case, as shown in FIG. **5**, when the battery-side electrical connector **200** has an inclination toward one mounting member side (for example, the mounting member **130**B side), the mounting member is greatly compression-deformed, and the vehicle-side connector **120** is greatly inclined with respect to the base bracket **110**. At this time, the ribs **142**, **144**, by being brought into contact against a lower surface **110***c* of the depression portion **112** of the base bracket **110**, can restrict a further inclination, so that the face-to-face arrangement between the base bracket **110** and the vehicle-side connector **120** can be maintained.

In the embodiment described above, because there are provided a pair of ribs **142**, **144** lined in the Y-direction and symmetrically with respect to the protrusion portion **140** to

restrict the foregoing inclination at the two spots, the face-to-face arrangement between the base bracket **110** and the vehicle-side connector **120** can be maintained more effectively. That is, for maintaining the face-to-face arrangement between the base bracket **110** and the vehicle-side connector **120** more efficiently, it is preferable to provide a plurality of ribs.

Also, restricting portions that restrict inclination of the base bracket **110** and the vehicle-side connector **120**, like the ribs **142**, **144** described above, can be in a mode of projecting from the front surface (lower surface **110***a*) closer to the vehicle-side connector **120** of the base bracket **110** toward the upper end surface **120***a* of the vehicle-side connector **120**, besides the mode of projecting from the front surface (upper end surface **120***a*) closer to the base bracket **110** of the vehicle-side connector **120** toward the lower surface **110***a* of the base bracket **110**.

In either mode of restricting portions, the restricting portions provided on one front surface, by being brought into contact against the other front surface, can restrict an inclination of the base bracket **110** and the vehicle-side connector **120**.

Next, the function of the stopper portion **160** composed of the protrusion portion **140** and the flange portion **152** will be described while referring to FIG. **6**.

When withdrawing the battery-side electrical connector **200** from the vehicle-side electrical connector **100**, a downward external force in the Z-direction such as to move the vehicle-side connector **120** away from the base bracket **110** is applied. In that case, as shown in FIG. **6**, when the battery-side electrical connector **200** has an inclination toward one mounting member side (for example, the mounting member **130**B side), the mounting member is greatly tensile-deformed or compression-deformed, and the vehicle-side connector **120** is greatly inclined with respect to the base bracket **110**. At this time, the flange portion **152** of the stopper portion **160**, by contacting an end portion thereof the bottom surface **110***b* of the depression portion **112**, can restrict a further inclination, so that the face-to-face arrangement between the base bracket **110** and the vehicle-side connector **120** can be maintained.

Second Embodiment

Next, a second embodiment of the present invention will be described while referring to FIG. **8** to FIG. **11**. The second embodiment is different from the first embodiment described above in the structure of a vehicle-side electrical connector and battery-side electrical connector, and is the same in other aspects.

The vehicle-side electrical connector **100**A according to the second embodiment is composed of a base bracket **110**A and a vehicle-side connector (automotive equipment-side connector) **120**.

The base bracket **110**A has the same structure as that of the base bracket **110** of the first embodiment described above except for the point of not including a portion of a depression **112** and an opening portion **114**. Also, the vehicle-side connector **120** is also the same in structure as the vehicle-side connector of the first embodiment described above.

Because the vehicle-side electrical connector **100**A does not include the mounting members **130**A, **130**B described above, the base bracket **110**A is directly connected to the upper end surface of the vehicle-side connector **120**. The connection between the vehicle-side connector **120** and the base bracket **110**A is performed by, for example, bonding such as vulcanization bonding.

The battery-side electrical connector **200**A according to the second embodiment is, as shown in FIG. **9** and FIG. **10**, composed of a battery-side connector **210**, a mounting member **220**, and a mounting attachment **230**.

The battery-side connector **210** is a part that is fitted with the vehicle-side connector **120** from the downside, and at its upper end surface, holes **212**, **214** into which alignment pins **126**A, **126**B and connector terminals C**1** of the vehicle-side connector **120** are inserted are respectively provided. In the respective holes **214** into which the connector terminals C**1** are inserted, connector terminals C**2** of the battery-side electrical connector **200** are disposed, respectively. The battery-side connector **210** is mounted on a base bracket **240** via the mounting member **220**. Also, although not shown, similar to the vehicle-side connector of the first embodiment, on the battery-side connector **210**, a protrusion portion that projects toward the base bracket **240** is provided, and the protrusion portion and a flange portion compose a stopper portion.

Similar to the mounting members **130**A, **130**B of the first embodiment, the mounting member **220** is a member for causing the battery-side connector **210** to be mounted in a state spaced at a predetermined interval with respect to the base bracket **240**, and is formed of rubber being a soft material. The mounting member **220** is in a tubular shape extending in an opposing direction (Z-direction) between the battery-side connector **210** and the base bracket **240**, the external shape of an X-Y section of which is an elliptical shape having a long diameter direction in the Y-direction. The mounting member **220** is, at its upper end surface, bonded to the battery-side connector **210**. Through an inner hole **220***a* of the mounting member **220**, a cable (not shown) electrically connected with the connector terminal C**2** is passed, and also in a region of the base bracket **240** corresponding to the inner hole **220***a*, a through-hole **240***a* for a cable is provided. Also, on a lower end surface (that is, a surface opposed to the base bracket **240**) **220***b* of the mounting member **220**, as to be described later, an annular projection portion **224** surrounding the inner hole **220***a* of the mounting member **220** is formed.

The mounting member **220** of the second embodiment provides the same effects as those of the mounting members **130**A, **130**B of the first embodiment. That is, according to the mounting member **220**, for the base bracket **240** and the battery-side connector **210**, a relative positional displacement in the compressing direction (Z-direction) as well as a relative positional displacement in a sliding direction (a direction in an X-Y plane) are permitted by elastic deformation of the mounting member.

The mounting attachment **230** is an annular rectangular flat plate interposed in part between the mounting member **220** and the base bracket **240** and having external dimensions larger than those of the mounting member **220**, and is embedded in a lower end portion of the mounting member **220** so as to surround the inner hole **220***a* of the mounting member **220**. The mounting attachment **230** is bonded to the mounting member **220**. At an inner edge of the mounting attachment **230**, an eaves portion **232** is formed throughout the entire edge region (that is, throughout the entire circumference of the inner hole **220***a* of the mounting member **220**). The eaves portion **232** is a part that was designed so as to separate by a predetermined distance from a lower end surface **230***b* of the mounting attachment **230**, and is not brought into contact against the base bracket **240**. The eaves portion **232** is located outside further than the inner hole **220***a* of the mounting member **220**, and buried near the inner hole **220***a* of the mounting member **220**, and over, under, and lateral to the eaves portion **232**, the material of the mounting member **220** exists.

There are provided through-holes **230***a* at the four corners of the mounting attachment **230**, and the mounting attachment **230** is, as shown in FIG. **8**, bolted on to the base bracket **240** by use of the through-holes **230***a*.

Then, the annular projection portion **224** formed on the lower end surface **220***b* of the mounting member **220** will be described while referring to FIGS. **11**(*a*) and (*b*).

As shown in FIG. **11**(*a*), on the lower end surface **220***b* of the mounting member **220**, there is formed an annular projection portion **224** at a position corresponding to an eaves portion **232** of the mounting attachment **230**. That is, similar to the eaves portion **232**, the annular projection portion **224** is formed throughout the entire circumference of the inner hole **220***a* of the mounting member **220**. The annular projection portion **224** has a section in a triangular shape that is sharpened at its point. Also, the sectional shape of the annular projection portion **224** is not limited to a triangle, and may be a trapezoid or a semicircle.

Because the annular projection portion **224** is projected from the lower end surface **220***b* of the mounting member **220** and the lower end surface **230***b* of the mounting attachment **230**, when the lower end surface **230***b* of the mounting attachment **230** and an upper surface of the base bracket **240** are fitted together so as to be closely adhered, a part **222** sandwiched between the eaves portion **232** of the mounting attachment **230** and the base bracket **240** is pressed from the up and down directions to produce a high internal stress. Here, the annular projection portion **224** and the eaves portion **232** are formed throughout the entire circumference of the inner hole **220***a* of the mounting member **220**, the compressed part **222** sandwiched between the eaves portion **232** of the mounting attachment **230** and the base bracket **240** is also produced throughout the entire circumference of the inner hole **220***a* of the mounting member **220**. In such an annular compressed part **222**, there is improved adhesion at a joint surface between the mounting member **220** and the base bracket **240**.

As described above, in the battery-side electrical connector **200**A, even when there is a positional displacement and/or inclination between the vehicle-side electrical connector **100**A and the battery-side electrical connector **200**A and a relative positional displacement in the sliding direction has occurred, self-correction is performed by elastic deformation of the mounting member **220**. Thus, according to the battery-side electrical connector **200**A, coupling when coupling the vehicle-side electrical connector **100**A can be easily performed.

Furthermore, because high sealability in the inner hole **220***a* of the mounting member **220** is realized as a result of the adhesion at a contact surface between the mounting member **220** and the base bracket **240** being improved by the annular compressed part **222** described above, entrance of water into the interior of a case of the battery-side electrical connector **200**A can be effectively prevented. Also, according to the conventional art, a separate waterproof seal has been required for exclusive use in order to prevent entrance of water into the interior of a battery case, which has caused an increase in the number of components, but according to the battery-side electrical connector **200**A, because the mounting member **220** serves also as a waterproof construction, no such waterproof seal is required. Consequently, a reduction in cost and an improvement in assemblability when manufacturing the battery-side electrical connector **200**A are achieved.

Third Embodiment

Next, a third embodiment of the present invention will be described while referring to FIG. **12** to FIG. **13**. The third embodiment is different from the first embodiment described above in the structure of a vehicle-side electrical connector, and is the same in other aspects.

The vehicle-side electrical connector **100**B according to the third embodiment is composed of a base bracket **110**B, a vehicle-side connector (automotive equipment-side connector) **120**, a mounting member **170**, and a mounting attachment **180**. The base bracket **110**B is the same as the base bracket **110** of the first embodiment described above except for the point of not including a portion of a depression **112** and an opening portion **114**. Moreover, the vehicle-side connector **120** is also the same as the vehicle-side connector of the first embodiment described above.

The mounting member **170** and the mounting attachment **180** of the third embodiment are members that are the same as the mounting member **220** and the mounting attachment **230** of the second embodiment.

That is, similar to the mounting member **220** of the second embodiment, the mounting member **170** is a member for causing the vehicle-side connector **120** to be mounted in a state spaced at a predetermined interval with respect to the base bracket **110**B, and is formed of rubber being a soft material. The mounting member **170** is in a tubular shape extending in an opposing direction (Z-direction) between the vehicle-side connector **120** and the base bracket **110**B, the external shape of an X-Y section of which is an elliptical shape having a long diameter direction in the Y-direction. The mounting member **170** is, at its lower end surface, bonded to the vehicle-side connector **120**. Moreover, as shown in FIG. **14**(*a*), on an upper end surface (that is, a surface opposed to the base bracket **110**B) **170***b* of the mounting member **170**, there is formed at a position corresponding to an eaves portion **182** of the mounting attachment **180** an annular protrusion portion **174** that is the same as the annular projection portion **224** of the second embodiment. Also, the mounting attachment **180** is bonded to the mounting member **170**.

Because the annular projection portion **174** is projected from the upper end surface **170***b* of the mounting member **170** and an upper end surface **180***b* of the mounting attachment **180**, when the upper end surface **180***b* of the mounting attachment **180** and a lower surface of the base bracket **110**B are fitted together so as to be closely adhered, a part **172** sandwiched between the eaves portion **182** of the mounting attachment **180** and the base bracket **110**B is pressed from the up and down directions to produce a high internal stress, and in the annular compressed part **172**, there is improved adhesion at a joint surface between the mounting member **170** and the base bracket **110**B.

The mounting member **220** is a member for causing the battery-side connector **210** to be mounted in a state spaced at a predetermined interval with respect to the base bracket **240**, is formed of rubber being a soft material, and provides the same effects as those of the mounting members **130**A, **130**B described above. That is, according to the mounting member **220**, for the base bracket **240** and the battery-side connector **210**, a relative positional displacement in the compressing direction (Z-direction) as well as a relative positional displacement in a sliding direction (a direction in an X-Y plane) are permitted by elastic deformation of the mounting member.

Similar to the vehicle-side electrical connector **100**, also in such a vehicle-side electrical connector **100**B, even when there is a positional displacement and/or inclination between the vehicle-side electrical connector **100**B and the battery-side electrical connector **200** and a relative positional displacement in the sliding direction has occurred, self-correction is performed by elastic deformation of the mounting

member **170**. Thus, according to the vehicle-side electrical connector **100**B, coupling when coupling the battery-side electrical connector **200** can be easily performed.

Furthermore, similar to the annular compressed part **222** of the second embodiment, because high sealability in the inner hole **170***a* of the mounting member **170** is realized as a result of the adhesion at a contact surface between the mounting member **170** and the base bracket **110**B being improved by the annular compressed part **172**, entrance of water into the interior of a case of the vehicle-side electrical connector **100**B can be effectively prevented. Consequently, a reduction in cost and an improvement in assemblability when manufacturing the vehicle-side electrical connector **100**B are achieved.

Also, the present invention is not limited to the embodiments described above, and various modifications can be made. For example, the constituent material for a mounting member is not limited to rubber, and various elastic materials such as a silicon resin and urethane can be adopted. Moreover, the mounting member can also be installed on a side surface of a vehicle-side electrical connector, not on an upper surface. Further, the shape and number of restricting portions such as ribs can be appropriately changed, and preferably, a plurality of restricting portions are provided.

Moreover, the vehicle-side connector **120** and the base bracket **110** can also be disposed so that their longitudinal direction corresponds to the vehicle front-rear direction.

It can also be considered to apply the electrical connector of the embodiment described above to, for example, a component that performs electrical connection simultaneously with mounting a heavy-weight component, such as a component for connection with a motor and inverter, a pump-related component, or the like, and absorbs a positional displacement and vibration.

REFERENCE SIGNS LIST

10: Electric vehicle
20: Battery unit
100, **100**A, **100**B: Vehicle-side electrical connector
110, **110**A, **110**B: Base bracket
120: Vehicle-side connector
130A, **130**B, **220**, **170**: Mounting member
140: Protrusion portion
142, **144**: Rib
152: Flange portion
160: Stopper portion
174, **224**: Annular projection portion
180, **230**: Mounting attachment
182, **232**: Eaves portion
200, **200**A: Battery-side electrical connector

The invention claimed is:

1. A connector component including a connector that composes a connector pair on an automotive equipment side and a battery side for mounting a battery in an automobile, the connector component comprising:

a base bracket to be fixed to a vehicle body or the battery; and

a mounting member formed of an elastic material, for causing the connector to be mounted in a state spaced at a predetermined interval with respect to the base bracket, wherein

the connector and the base bracket are integrally constructed via the mounting member,

said connector component further comprising a mounting attachment for fixing the mounting member to the base bracket, wherein

the mounting member is in a tubular shape extending in an opposing direction between the connector and the base bracket,

the mounting attachment has an annular eaves portion embedded in the mounting member so as to surround an inner hole of the mounting member, and not to be brought into contact with the base bracket, and

the mounting member has an annular projection portion formed at a position, of a surface opposed to the base bracket, corresponding to the annular eaves portion.

2. The connector component according to claim **1**, wherein the mounting member is formed of rubber.

3. The connector component according to claim **2**, wherein the base bracket is provided with an opening portion on which a stopper portion that projects from a front surface of the connector closer to the base bracket is locked in a penetrating manner, and

by cooperation of the stopper portion of the connector with the opening portion of the base bracket, detachment of the connector from the base bracket is prevented.

4. The connector component according to claim **1**, wherein the mounting member is bonded to the connector and the base bracket by vulcanization bonding.

5. The connector component according to claim **4**, wherein the base bracket is provided with an opening portion on which a stopper portion that projects from a front surface of the connector closer to the base bracket is locked in a penetrating manner, and

by cooperation of the stopper portion of the connector with the opening portion of the base bracket, detachment of the connector from the base bracket is prevented.

6. The connector component according to claim **1**, wherein the base bracket is provided with an opening portion on which a stopper portion that projects from a front surface of the connector closer to the base bracket is locked in a penetrating manner, and

by cooperation of the stopper portion of the connector with the opening portion of the base bracket, detachment of the connector from the base bracket is prevented.

7. The connector component according to claim **1**, wherein,

on one front surface out of a front surface of the base bracket closer to the connector and a front surface of the connector closer to the base bracket, a restricting portion that projects toward the other front surface, and restricts inclination of the base bracket and the connector by being brought into contact with the other front surface is provided.

8. The connector component according to claim **1**, being an automotive equipment-side connector component.

9. The connector component according to claim **1**, being a battery-side connector component.

* * * * *